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A DATA BASE MANAGEMENT SYSTEM FOR THE BIOMINET NETWORK

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MICROMEDIA

A DATA BASE MANAGEMENT SYSTEM FOR THE BIOMINET NETWORK

by

W.S. Bowman*

SUMMARY

A data base has been set up for the BIOMINET network using System 2000 software on the EMR-CSC Cyber 170 computer. The data base contains information on activities, interests and resources of research organizations, companies and associated agencies interested in the applications of biological systems in mineral processing.

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GESTION DU RÉSEAU BIOMINET À L'AIDE D'UNE BASE DE DONNÉES

par

W.S. Bowman*

RÉSUMÉ

On a élaboré une base de données utilisant le logiciel 2000 sur l'unité centale EMR-CSC Cyber 170/730 pour le réseau BIOMINET. La base de données contient de l'information sur les activités, les intérêts et les ressources des organismes de recherche, des sociétés et organismes affiliés qu'intéressent les applications des systèmes biologiques à l'industrie minérale.

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INTRODUCTION

BIOMINET is the Mineral Leaching and Metal Recovery Network. It is one of four national biotechnology research networks set out in the National Biotechnology Strategy announced by the Ministry of State for Science and Technology (MOSST) in 1983.

The purpose of these networks is to strengthen Canadian research capability in the area of biotechnology by linking together university, provincial research organization, industrial and federal laboratories.

CANMET has been given responsibility for the formation and operation of BIOMINET because of its expertise in the field of biotechnological research.

In early 1984 the secretary of BIOMINET, H.W. Parsons, sent a survey questionnaire to BIOMINET participants, potential participants and interested parties. The survey questionnaire is reproduced in APPENDIX A. As more and more completed surveys began coming back, it became increasingly evident that a computerized system would be advantageous for filing and analysing these results.

System 2000 was chosen as the data base management software for this task because it was readily available on the CSC/CYBER system and because MSL had considerable experience with the product.

There are 203 organization-entries in the data base at the time of writing.

DATA BASE DESCRIPTION

System 2000* (S2K) is an hierarchial data base management system (DBMS) in which data is logically stored in a tree-like structure with a single entry at the top and branches spreading out underneath. The actual design of a data base depends on the relationships among the data to be

---

*System 2000 is a DBMS developed and maintained by Intel Systems Corporation, Austin, Texas. (During preparation of this report it was learned that S2K was sold to SAS Inc., a large American software company).

entered and what types of retrievals are required. In some cases the data has to be "squeezed" to conform to the defined structure.

For the BIOMINET data base, the schema is based on the survey questionnaire: it is shown in Figure 1. Data for every organization that is entered must follow this schema. The S2K definition commands are given in Figure 2. An organization can have multiple entries under each heading as shown in the example in Figure 3.

A detailed description of each schema item follows:

C1 ORG. NO. - a unique organization number which is used to facilitate retrievals from the data base. As each new organization is added, the ORG. NO. is automatically incremented.

C2 NAME - a 20-character alphanumeric which identifies the organization.

C3 TYPE - A 4-character code denoting the type of organization. The following tally shows the nine codes in use of the present time.

```
TALLY C3\
*****************************************
 ITEM-          TYPE
*****************************************
OCCURRENCES    VALUE
-----------------------------------------
         6      BIO
        11      CONS
         4      ENG
        53      FED
        69      IND
        10      OTH
         9      PRO
         8      RES
        33      UNIV
-----------------------------------------
         9  DISTINCT VALUES
-----------------------------------------
       203  TOTAL OCCURRENCES
-----------------------------------------
---
```

Figure 1. Schema tree of BIOMINET data base

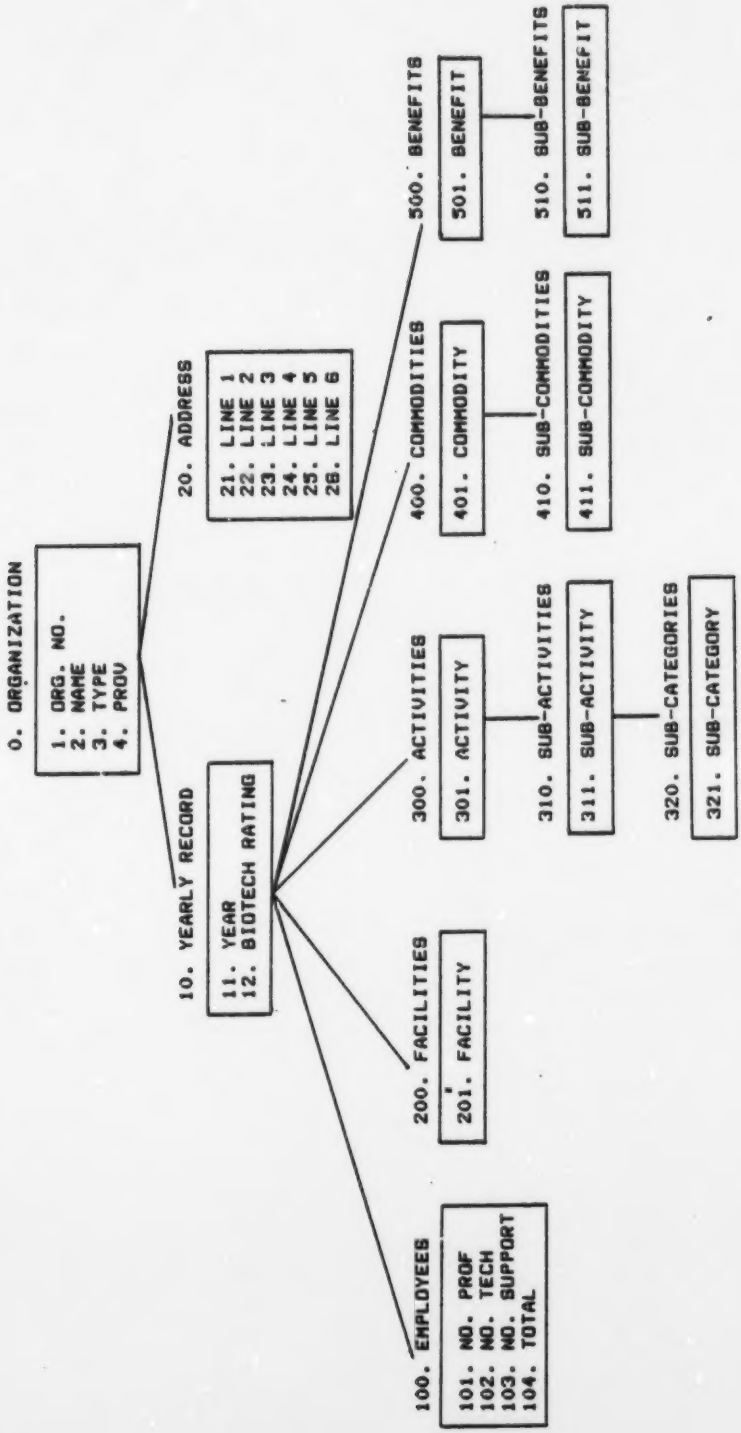
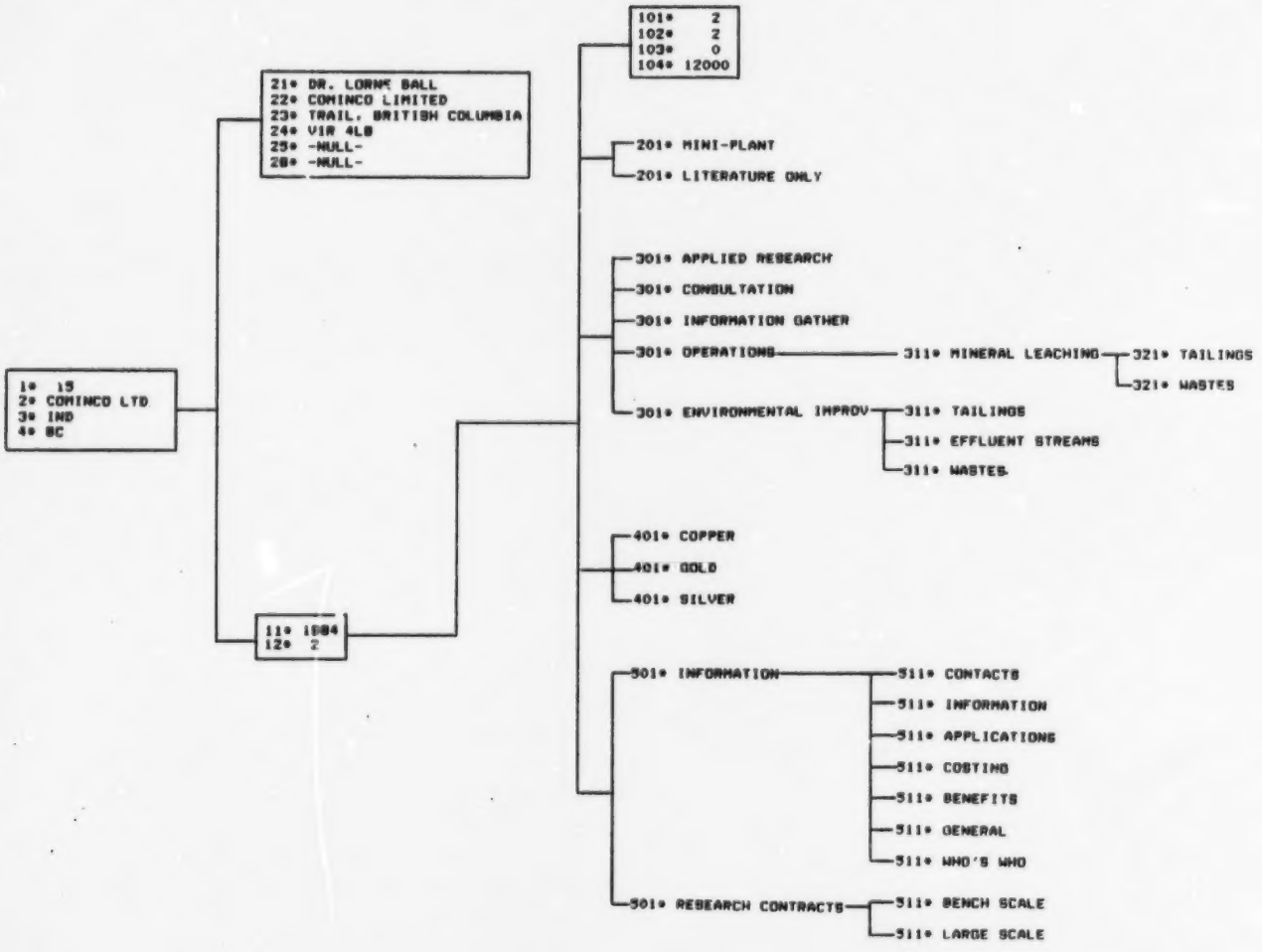


Figure 2. S2K definition commands for BIOMINET data base

```
SYSTEM RELEASE NUMBER        M2.80D
DATA BASE NAME IS BIOMINET
DEFINITION NUMBER       2
DATA BASE CYCLE       241
    1*  ORG. NO. (INTEGER NUMBER 999)\
    2*  NAME (CHAR X(20))\
    3*  TYPE (CHAR XXXX WITH MANY FUTURE OCCURRENCES )\
    4*  PROV (CHAR XXXX WITH MANY FUTURE OCCURRENCES )\
   10*  YEARLY RECORD (RECORD)\
     11*  YEAR (CHAR XXXX IN 10 WITH  FEW FUTURE OCCURRENCES )\
     12*  BIOTECH RATING (NON-KEY INTEGER NUMBER 99 IN 10)\
    100*  EMPLOYEES (RECORD IN 10)\
      101*  NO. PROF (NON-KEY INTEGER NUMBER 9999 IN 100)\
      102*  NO. TECH (NON-KEY INTEGER NUMBER 9999 IN 100)\
      103*  NO. SUPPORT (NON-KEY INTEGER NUMBER 9999 IN 100)\
      104*  TOTAL (NON-KEY INTEGER NUMBER 9(5) IN 100)\
    200*  FACILITIES (RECORD IN 10)\
      201*  FACILITY (CHAR X(20) IN 200 WITH MANY FUTURE OCCURRENCES )\
    300*  ACTIVITIES (RECORD IN 10)\
      301*  ACTIVITY (CHAR X(20) IN 300 WITH  FEW FUTUREE OCCURRENCES )\
      310*  SUB-ACTIVITIES (RECORD IN 300)\
        311*  SUB-ACTIVITY (CHAR X(20) IN 310 WITH  FEW FUTURE OCCURRENCES )\
        320*  SUB-CATEGORIES (RECORD IN 310)\
          321*  SUB-CATEGORY (CHAR X(20) IN 320 WITH  FEW FUTURE OCCURRENCES )\
    400*  COMMODITIES (RECORD IN 10)\
      401*  COMMODITY (CHAR X(20) IN 400 WITH  FEW FUTURE OCCURRENCES )\
      410*  SUB-COMMODITIES (RECORD IN 400)\
        411*  SUB-COMMODITY (CHAR X(20) IN 410)\
    500*  BENEFITS (RECORD IN 10)\
      501*  BENEFIT (CHAR X(20) IN 500 WITH  FEW FUTURE OCCURRENCES )\
      510*  SUB-BENEFITS (RECORD IN 500)\
        511*  SUB-BENEFIT (CHAR X(20) IN 510)\
   20*  ADDRESS (RECORD)\
     21*  LINE 1 (NON-KEY CHAR X(35) IN 20)\
     22*  LINE 2 (NON-KEY CHAR X(35) IN 20)\
     23*  LINE 3 (NON-KEY CHAR X(35) IN 20)\
     24*  LINE 4 (NON-KEY CHAR X(35) IN 20)\
     25*  LINE 5 (NON-KEY CHAR X(35) IN 20)\
     26*  LINE 6 (NON-KEY CHAR X(35) IN 20)\
---
```

Figure 3. Data tree for Organization No. 15



C4 PROV - a 4-character provincial code. For countries other than Canada, a state or country code can be used. The following tally shows the 15 codes in use at the present time.

```
TALLY C4\
*******************************************
 ITEM-          PROV
*******************************************
OCCURRENCES   VALUE
-------------------------------------------
        11       ALB
         1       AUS
        23       BC
         1       ID
         5       MAN
         9       NB
         3       NFLD
         1       NM
        10       NS
         2       NWT
       108       ONT
        21       QUE
         6       SASK
         1       UTAH
         1       YUK
-------------------------------------------
        15  DISTINCT VALUES
-------------------------------------------
       203  TOTAL OCCURRENCES
-------------------------------------------
---
```

C11 YEAR - A 4-character year. It is anticipated that the same organization might submit another complete survey in a following year or indeed in the same year (there could be two data trees under 1984). As shown in the following tally, 135 organizations had not submitted a survey at the time of writing.

```
*TALLY (C11)\
-473- NO ERRORS HAVE OCCURRED -
************************
     TALLY WHERE
************************
FREQUENCY  VALUE
- ----------------------
      135       -NULL-
       68       1984
------------------------
        2  UNIQUE VALUES
------------------------
      203  OCCURENCES
------------------------
- --
```

C12 BIOTECH RATING - companies were asked to rate relevance of biotechnology to the mineral industry on a scale of 0 to 10. The following tallies their replies.

*TALLY (C12)\
-473- NO ERRORS HAVE OCCURRED -

TALLY WHERE	
FREQUENCY	VALUE
135	-NULL-
8	00
2	01
4	02
9	03
2	04
10	05
6	06
11	07
5	08
2	09
9	10
12	UNIQUE VALUES
203	OCCURENCES

C20 ADDRESS - this record consists of 6 data items each one of which is a line of the organization's address. They may be accessed individually as items C21 to C26. Each line can have a maximum of 35 characters so that the address will fit on a standard sticky address label.

C101 NO. PROF
C102 NO. TECH
C103 NO. SUPPORT
} - no. of employees engaged in biotech research and development

C104 TOTAL - total number of employees

C201 FACILITY - biotechology facilities reported.

```
*TALLY (C201)\
-473- NO ERRORS HAVE OCCURRED -
************************
     TALLY WHERE
************************
FREQUENCY  VALUE
------------------------
      147       -NULL-
       22       ANALYTICAL
       29       BENCH SCALE
       34       LITERATURE ONLY
       18       MINI-PLANT
       10       PILOT-PLANT
------------------------
        6  UNIQUE VALUES
------------------------
      260  OCCURENCES
------------------------
---
```

C301 ACTIVITY - the following shows the biotechnological activities reported.

```
*TALLY (C301)\
-473- NO ERRORS HAVE OCCURRED -
************************
     TALLY WHERE
# ************************
FREQUENCY  VALUE
------------------------
      136       -NULL-
       44       APPLIED RESEARCH
       23       BASIC RESEARCH
        1       BIO-TESTING
       15       CONSULTATION
       13       CORROSION
       26       ENGINEERING
        1       ENVIRONMENTAL EFFECT
       56       ENVIRONMENTAL IMPROV
       36       INFORMATION GATHER
       56       OPERATIONS
        1       PROCESS DEVELOPMENT
        1       SCIENCE POLICY
       13       TEACHING
------------------------
       14  UNIQUE VALUES
------------------------
      422  OCCURENCES
------------------------
---
```

C311 SUB-ACTIVITY - three activities have been divided into sub-activities. These are tallied individually below.

```
*TALLY (C311) WH C301 EQ CORROSION\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  310  -
*:**********************
     TALLY WHERE
*:**********************
FREQUENCY  VALUE
-----------------------
       10       CONSTR METALS
        8       PIPELINES
-----------------------
        2  UNIQUE VALUES
-----------------------
       18  OCCURENCES
-----------------------
---
```

```
*TALLY (C311) WH C301 EQ ENVIRONMENTAL IMPROV\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  310  -
*:**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
-----------------------
        3       -NULL-
        1       ACID MINE DRAINAGE
        1       BIOSORBENTS
        1       DEMETHANATION
       46       EFFLUENT STREAMS
        1       MILL TAILINGS
        1       OIL/WATER EMULSION
       44       TAILINGS
       33       WASTES
-----------------------
        9  UNIQUE VALUES
-----------------------
      131  OCCURENCES
-----------------------
---
```

```
*TALLY (C311) WH C301 EQ OPERATIONS\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  310  -
**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
----------------------
        1       -NULL-
       21       LIQUID-SOLID SEP
       38       METAL RECOVERY
       22       MINERAL BENEFIC
       50       MINERAL LEACHING
----------------------
        5  UNIQUE VALUES
----------------------
      132  OCCURENCES
----------------------
---
```

C321 **SUB-CATEGORY - five of the sub-activities have been further sub-divided into sub-categories. They are tallied individually below.**

```
*TALLY (C321) WH C311 EQ LIQUID-SOLID SEP\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  320  -
**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
----------------------
        1       ELECTRO-MAGNETIC
        1       EQUIPMENT
        1       MEMBRANE PROCESSING
       20       SETTLING AGENTS
        1       SURFACTENTS
----------------------
        5  UNIQUE VALUES
----------------------
       24  OCCURENCES
----------------------
---
```

```
*TALLY (C321) WH C311 EQ METAL RECOVERY\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  320  -
**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
----------------------
      24       BIOSORPTION
       1       ION EXCHANGE
       1       MEMBRANE PROCESSING
       1       METAL RESISTANCE
      25       METAL SEPARATION
       1       NOVEL BIOMEMBRANES
      24       PRECIPITATION
----------------------
       7  UNIQUE VALUES
----------------------
      77  OCCURENCES
----------------------
---
```

```
*TALLY (C321) WH C311 EQ MINERAL BENEFIC\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  320  -
**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
----------------------
       1       AGGLOMERATION
       1       COAL FLOTATION
      20       FLOCCULATION
       1       FLOTATION
       6       PELLET BINDING
----------------------
       5  UNIQUE VALUES
----------------------
      29  OCCURENCES
----------------------
---
```

```
*TALLY (C321) WH C311 EQ MINERAL LEACHING\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  320  -
**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
- ---------------------
        1       COAL CLEANING
       27       CONCENTRATES
        1       CRUDE OILS/BITUMENS
        1       LEACHING CHEMICALS
       34       ORES
        1       PLASMA GENETICS
       38       TAILINGS
       30       WASTES
- ----------------------
        8  UNIQUE VALUES
----------------------
      133  OCCURENCES
----------------------
- --
```

```
*TALLY (C321) WH C311 EQ PIPELINES\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  320  -
**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
-----------------------
        1       BACTERIACIDES
        1       BIOFOULING
        1       EQUIPMENT
        5       OIL
        1       SLURRY
        4       SOLUTION
-----------------------
        6  UNIQUE VALUES
- ----------------------
       13  OCCURENCES
- ----------------------
---
```

C401 COMMODITY - the following tally gives the commodities listed by the biotech organizations.

```
*TALLY (C401)\

-473- NO ERRORS HAVE OCCURRED -
************************
     TALLY WHERE
************************
FREQUENCY  VALUE
------------------------
      145       -NULL-
        1       ALL
        6       ALUMINUM
        1       BITUMEN
        1       CHROMIUM
       17       COAL
       19       COAL AND GAS
       38       COPPER
        1       GALLIUM
       31       GOLD
       17       LEAD
        1       MAGNESIA
        1       MANGANESE
        1       MANY METALS
        1       MOLYBDENUM
       14       NICKEL
        9       OIL
        1       PEAT
        1       PRECIOUS METALS
        1       RADIUM
       26       SILVER
        1       TIN
        1       TUNGSTEN
       22       URANIUM
       26       ZINC
------------------------
       25  UNIQUE VALUES
------------------------
      383  OCCURENCES
------------------------
---
```

C411 SUB-COMMODITY - one commodity, COAL and GAS, is divided into sub-commodities. They are shown in the tally below.

```
*TALLY (C411) WH C401 EQ /COAL AND GAS/\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  410  -
**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
----------------------
       12       BENEFICIATION
        1       ENHANCED OIL RECOVER
       13       ENVIRONMENTAL
        1       METHANE UTILIZ
----------------------
        4  UNIQUE VALUES
----------------------
       27  OCCURENCES
----------------------
---
```

C501 BENEFIT - benefits sought from participation in BIOMINET are tallied below.

```
*TALLY (C501)\

-473- NO ERRORS HAVE OCCURRED -
**********************
     TALLY WHERE
**********************
FREQUENCY  VALUE
----------------------
      138       -NULL-
        4       INFORMATION
       34       RESEARCH CONTRACTS
----------------------
        3  UNIQUE VALUES
----------------------
      236  OCCURENCES
----------------------
---
```

C511 **SUB-BENEFIT - both benefits are divided into sub-benefits. These are tallied separately.**

```
*TALLY (C511) WH C501 EQ INFORMATION\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  510  -
************************
     TALLY WHERE
************************
FREQUENCY  VALUE
-----------------------
       43       APPLICATIONS
       26       BENEFITS
       48       CONTACTS
       24       COSTING
       37       GENERAL
       54       INFORMATION
        1       R&D CONTRACTS
       29       WHO'S WHO
-----------------------
        8  UNIQUE VALUES
-----------------------
      262  OCCURENCES
-----------------------
- --
```

```
*TALLY (C511) WH C501 EQ RESEARCH CONTRACTS\
-473- NO ERRORS HAVE OCCURRED -
-479- LOWEST SELECTED RECORD COMMON TO ALL REPORTS IS  510  -
************************
     TALLY WHERE
************************
FREQUENCY  VALUE
-----------------------
       18       BASIC DATA
       22       BENCH SCALE
        1       FOR TRACE ANALYSES
       12       LARGE SCALE
        1       LIMITED TESTING
       24       TECHNOL ASSESS
-----------------------
        6  UNIQUE VALUES
-----------------------
       78  OCCURENCES
-----------------------
- --
```

UPDATING

Small changes and additions to the data base are easily accomplished with the interactive language, QUEST, (often referred to as NATURAL LANGUAGE)[1]. However, adding data from survey results for many organizations is another matter. To accomplish this, a FORTRAN Procedural Language (PLEX) program has been written. This program, because of its size, must be run in Batch Mode. It is designed to add new survey data to already existing organization trees and to create totally new trees (for which "ORG. NO." is automatically supplied).

In order to complete the mailing list, it was decided to add 135 organizations which had not sent in completed surveys. Because it was expected that this would be an on-going requirement, it was decided to separate the updating process into two steps. Step 1 would be to create a data tree with the basic information (organization number, name, type, province and mailing address). Step 2 would be to add survey data to an existing data tree if and when such data is received. For Step 1 an interactive procedure, BIONEW, has been created. This procedure automatically assembles the data in a batch job and sends it for processing. It is pretty well self-explanatory and is executed by typing simply BIONEW. An example follows in Figure 4 wherein data entered by the user is in lower case and prompts from the computer are in upper case.

It must be emphasized that the BIONEW procedure does not itself update the data base. It creates and submits a batch job to do the updating. A copy of the batch job is stored on a premanent file for 5 days in case it has to be re-run. The copy from the above example is shown in Figure 5.

The user need not concern himself too much with the details of this batch job. It is shown to emphasize the point that the actual updating is done by the PLEX program BIOUPDT.

The output from this job gives a summary of data entered to the data base and a dayfile. It is returned to the terminal as a REMOTE OUTPUT FILE where it can be recovered and examined or printed.

Figure 4. Step 1 updating using BIONEW

```
COMMAND- bionew

PROCEDURE FOR ENTERING NEW ORGANIZATIONS TO BIOMINET DATA BASE

ENTER ORGANIZATION NAME (MAX 20 CHARS)
cominco ltd          !

ENTER ORGANIZATION TYPE - CHOICES ARE: BIO, CONS, ENG, FED, IND,
                                       PRO, RES, UNIV, OTH
ind

ENTER PROV. CODE (MAX 4 CHARS) OR ENTER A BLANK
bc  !

ENTER 6-LINE ADDRESS (MAX 35 CHARS PER LINE)

    BLANK LINES MUST BE ENTERED

ENTER LINE 1
dr. lorne ball                    !

ENTER LINE 2
cominco limited                   !

ENTER LINE 3
trail, british columbia           !

ENTER LINE 4
v1r 4l8                           !

ENTER LINE 5
                                  !

ENTER LINE 6
                                  !

COMPLETE ADDRESS IS:  DR. LORNE BALL
                      COMINCO LIMITED
                      TRAIL, BRITISH COLUMBIA
                      V1R 4L8

ARE YOU SATISFIED? (ENTER 'Y' OR 'N')
y

ANY MORE ORGANIZATIONS? (ENTER 'Y' OR 'N')
n

ALL OF THE DATA ENTERED HAS BEEN SUBMITTED TO S2K
TO UPDATE THE DATA BASE IN A BATCH JOB

(A COPY OF THE DATA IS ALSO STORED FOR 5 DAYS: PF=BIOTEMP,ID=WSB

THE PRINT-OUT WILL COME TO YOUR TERMINAL AS A REMOTE OUTPUT FILE
CHECK THE OUTPUT TO ENSURE THAT UPDATING WAS SUCCESSFUL

COMMAND-
```

Figure 5. Copy of batch job created by BIONEW

```
COMMAND- attach,a,biotemp,id=wsb
 AT CY= 003 SN=PUBLIC2
COMMAND- copysbf,a
```

```
ISHAN,CM150000,T100,IO500,P2.
ACCOUNT,*****.
ATTACH,BIOUPDT,ID=WSB,MR=1.
BEGIN,S2K,,S2KFTN,INPUT=BIOUPDT,OUTPUT=0.
ATTACH,LIB1,BIOLIB,ID=WSB,MR=1.
ATTACH,LIB2,CCRMPLIB,ID=WSB,MR=1.
LIBRARY,LIB1,LIB2.
COPYCR,INPUT,TAPE1.
REWIND,TAPE1.
LGO.
0          COMINCO LTD          IND  BC
DR. LORNE BALL
COMINCO LIMITED
TRAIL, BRITISH COLUMBIA
V1R 4L8


0 0 0 0 0

COMMAND-
```

Step 2 updating requires a lot more data to be entered. It follows the survey questionnaire item by item. During development of this system, it was found convenient to have the data keypunched at the Computer Science Centre and to read the cards in to the card reader at 555 Booth Street. This is still a good technique, but it was felt that it would be more convenient, if not simpler, to enter the data on a floppy disk using WORDSTAR™ and to transmit it to the CYBER computer for processing. Accordingly, for Step 2 an interactive procedure, BIOOLD, has been created. Unlike BIONEW, this procedure can only be run on a micro computer using CP/M™. BIOOLD supplies all necessary control cards, performs transfer to the CYBER, does necessary re-formatting and editing and batches the job to the input queue. To use it, first create a data file, then load a communications program on the micro, log onto the CYBER and type BIOOLD. An example follows in Figure 6.

The data file DATA.1 is shown as an example in Figure 7. What is shown is data from two surveys; several could be on the same file one after another. The entries in capital letters on the right are not required - they are included here to show how each line corresponds to a block on the BIOMINET Survey Questionnaire. Also the entries "cambrian college", "univ" and "ont" are not used by the computer. This information is already in the data base for organization no. 114. It is useful to have this on the data file, however; otherwise, later on, one would have to access the data base to find out whose survey this was. Note that there must be 5 items on line 2 each one separated by a space; if some are absent on the survey, zeros must be entered. The same goes for the biotech rating on line 15. For all other lines, a blank is left for unchecked items. Note also that if a whole line is blank, this must be entered as at least 1 blank space followed by a carriage return. Survey entries opposite "OTHER* - *Specify" are entered on the same line starting at column 16. Only 20 characters are permitted - additional ones entered are truncated. Examples of this (microbial processes) are shown in Figure 7.

The output from the batch job created by BIOOLD gives a summary of the data transmitted from the floppy disk. It is returned to the terminal as a REMOTE OUTPUT FILE where it can be recovered and printed. In case of error, the data file must be corrected using WORDSTAR™ and re-transmitted. Erroneous items may have to be removed from the data base as well.

Figure 6. Step 2 updating using BIOOLD

```
COMMAND- bioold

 PROCEDURE FOR ENTERING SURVEY DATA TO DATA BASE

 DATA MUST BE ON MICRO WORDSTAR FILE
 SEE DATA.1 FOR EXAMPLE FORMAT

 XMODEM TRANSFER ... PLEASE WAIT ...

XMODEM  V1.4

YOU MAY NOW SEND THE FILE. [esc e]
[MEX] A0>> st data.2
File open: 2 records
Send time: 0 mins, 2 secs at 1200 bps
CTL-C cancels
Awaiting ready signal

Checksum requested
Sending #1
Sending #2
[Transfer Completed]

[MEX] [Term: CTL-[ + "?" for help]
FILE SIZE           1 PRUS

REFORMATTING FILE ... PLEASE WAIT ...

EDITING FILE ... PLEASE WAIT ....

BATCHING FILE ... PLEASE WAIT ...

ALL OF THE DATA HAS BEEN SUBMITTED TO S2K
TO UPDATE THE DATA BASE IN A BATCH JOB
THE PRINT-OUT WILL COME BACK TO YOUR TERMINAL
AS A REMOTE OUTPUT FILE

INITIAL CATALOG
CT ID=     ISHAN PFN=XXXX
CT CY= 001 SN=PUBLIC2 0000000064 WORDS.
AT CY= 064 SN=PUBLIC
     END  XFORMAT
     34200 MAXIMUM EXECUTION FL.
     0.344 CP SECONDS EXECUTION TIME.
PR ID=     ISHAN PFN=XXXX
PR CY= 001 SN=PUBLIC2 0000000064 WORDS.
COMMAND-
```

Figure 7. File DATA.1 (BIOMINET survey data)

```
                col 1          col 11                    col 31  col 36
                  |              |                         |       |
                  v              v                         v       v
                114          cambrian college          univ ont        ..... ORGANIZATION
                1985 0 0 0 0                                           ..... EMPLOYEES
                x  x                                                   ..... FACILITIES
                xxxx  xx                                               ..... ACTIVITIES
                xxxx                                                   ..... LEACHING
                xxx                                                    ..... METAL RECOVERY
                x                                                      ..... LIQUID-SOLID
first           xx                                                     ..... MINERAL BEN.
survey          xxx                                                    ..... ENVIR. IMPR.
                xxxxxxx x                                              ..... COMMODITIES
                xx                                                     ..... COAL & GAS
                x                                                      ..... CORROSION
                 xxxxx                                                 ..... BENEFITS
                 xx x                                                  ..... BENEFITS
                7                                                      ..... RATING
-------------------------------------------------------------------------------------
                206          beacon research           cons ont
                1985 3 2 0 1
                xx x
                   xxxxx
                xxxx
                xx x              microbial processes
                xx                adsorbants & flocculants
second          x x               microbial processes
survey          xxx
                xxxxxxxxxx
                xx
                   x              microbial processes
                xx                      |
                xxx x                   |
                10                      |
                                        v
                                     col 16
```

AD HOC RETRIEVALS

The commands required to access the data base and to perform various retrievals are shown in Figure 8 in lower case; computer output is in upper case. The two verbs shown are PRINT and LIST. A very useful verb is TALLY (or *TALLY). Several examples are given in an earlier section. TALLY tells the user what data items are stored under each schema item (and how many of each). This can be used in subsequent PRINT and LIST WHERE clauses. For example, from a TALLY of C4 it is known that there are 6 occurrences of SASK. The first LIST command gives basic information on these organizations. The PRINT command gives the address of one of these.

In a second example, a TALLY of C301 has shown 13 occurences of the activity CORROSION. The LIST command gives full details on all these organizations. In order to make the retrievals needed, one must first consult the schema tree (Figure 1) to find component numbers and, second, do a TALLY or *TALLY with a WHERE clause to determine what information is stored in the components of interest. Then, a specific LIST or PRINT command can be formulated.

MAILING LABELS

This is a special retrieval since output is not directed to the screen or printer but to a local file. After creation, the user must exit from S2K, execute a program, S2KLABL, and route the product to a central site printer for printing on special label paper. Complete details are given in Figure 9 followed by part of the label output in Figure 10.

Figure 8. Typical ad hoc retrievals

```
begin,s2k,,opt=$cr=75$

*S2KM2B0*  NATURAL LANGUAGE
14/02/85  08.38.19. BEGIN SYSTEM 2000  RELEASE M2.80D
---

 AT CY= 194 SN=PUBLIC
user,parsons\
---
dbn is biominet\
-556-   ASSIGNED   BIOMINET                2   250 85/02/13. 16.25.34.
---
list c1,c2,c3,c4,c11 wh c4 eq sask\

  ORG. NO.   NAME                    TYPE   PROV   YEAR
***
*       22   AMOK LTD                IND    SASK   1984
*       29   SASK RESEARCH COUNC     PRO    SASK   1984
*       99   GULF MINERALS           IND    SASK
*      196   MELIS CONSULTING ENG    OTH    SASK
*      199   G. MALCOLM & ASSOCIA    OTH    SASK
*      204   URANEZ EXPLORATION &    IND    SASK
---
print/null/ c20 wh c1 eq 99\

  21* A. MORRISH
  22* GULF MINERALS CANADA LIMITED
  23* P.O. BOX 2070
  24* SASKATOON, SASKATCHEWAN
  25* S7K 3S7
  26* -NULL-
---


list c1,c2,c3,c4,c301,c311,c321 wh c301 eq corrosion\
  ORG. NO.   NAME                    TYPE   PROV   ACTIVITY     SUB-ACTIVITY          SUB-CATEGORY
***
*       12   PAMOUR PORCUPINE        IND    ONT    CORROSION    CONSTR METALS
*       13   RIO ALGOM LTD           IND    ONT    CORROSION    CONSTR METALS
*                                                                PIPELINES             SOLUTION
*       27   RESEARCH PROD COUNC     PRO    NB     CORROSION    CONSTR METALS
*       28   NOVA SCOTIA RESEARCH    PRO    NS     CORROSION    CONSTR METALS
*       30   SOQUEM                  OTH    QUE    CORROSION    CONSTR METALS
*       34   CANMET - EMR            OTH    ONT    CORROSION    PIPELINES             OIL
*                                                                                     BACTERIACIDES
*       37   DALHOUSIE UNIVERSITY    UNIV   NS     CORROSION    CONSTR METALS
*                                                                PIPELINES             OIL
*                                                                                     SOLUTION
*       45   WRIGHT ENGINEERS        OTH    BC     CORROSION    CONSTR METALS
*                                                                PIPELINES             SOLUTION
*                                                                                     EQUIPMENT
*       59   ONTARIO RESEARCH FOU    PRO    ONT    CORROSION    CONSTR METALS
*                                                                PIPELINES             OIL
*                                                                                     SOLUTION
*       63   CANMET - EMR            OTH    ONT    CORROSION    CONSTR METALS
*                                                                PIPELINES             OIL
*                                                                                     BIOFOULING
*       65   C-I-L INC.              IND    ONT    CORROSION    PIPELINES             OIL
*       66   ACRES DAVY MCKEE        IND    ONT    CORROSION    CONSTR METALS
*       67   S.A. INST. OF TECH.     UNIV   AUS    CORROSION    PIPELINES             SLURRY
---
exit\
-506-   CLOSED     BIOMINET                2   250 85/02/13. 16.25.34.
85/02/14. 11.06.30. END   SYSTEM 2000  RELEASE M2.80D
COMMAND-
```

Figure 9. Procedure for creating address labels

```
begin,s2k,,opt=$cr=75$

*S2KM280*  NATURAL LANGUAGE
14/02/85  11.15.06. BEGIN SYSTEM 2000  RELEASE M2.80D
---
user,parsons\
---
dbn is biominet\
-556-   ASSIGNED   BIOMINET                    2   250 85/02/13. 16.25.34.
---
print/stub suppress,null/\
---
report file is tape5\
---
print c20 wh c0 has c11 eq 1984\
---
exit\
-506-   CLOSED     BIOMINET                    2   250 85/02/13. 16.25.34.
85/02/14. 11.19.13. END   SYSTEM 2000  RELEASE M2.80D
COMMAND- rewind,tape5
COMMAND- request,tape6,*9
COMMAND- s2klabl

      END  S2KLABL
COMMAND- route,tape6,dc=pr,fc=11,tid=c
COMMAND-
```

Figure 10. Label output from the previous example

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

R.G. BRADBURN
BRENDA MINES LTD.
P.O. BOX 420
PEACHLAND, B.C.
V0H 1X0

D. WADDEN, METHODS ENGINEER
DENISON MINES LIMITED
BOX B-2600
ELLIOT LAKE, ONTARIO
P5A 2K2

DR. IRWIN J. ITZKOVITCH
ELDORADO RESOURCES LTD
SUITE 400, 255 ALBERT
OTTAWA, ONTARIO, CANADA
K1P 6A9

F.G.T. PICKARD
FALCONBRIDGE LIMITED
BOX 40, COMMERCE COURT WEST
TORONTO, CANADA
M5L 1B4

REFERENCE

1. QUEST Language Specification Manual, CDC NOS and NOS/BE Version; Intel Systems Corporation, Publication #221126; Release 2.80.

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Research and Technology
Recherche et technologie

Canada Centre for Mineral and Energy Technology,
555 Booth Street
Ottawa, Ontario
K1A 0G1

Centre canadien de la technologie des minéraux et de l'énergie,
555, rue Booth,
Ottawa (Ontario)
K1A 0G1

APPENDIX A

Your file Votre référence

Our file Notre référence

BIOMINET SURVEY

MINERAL LEACHING AND METAL RECOVERY NETWORK OF NATIONAL BIOTECHNOLOGY RESEARCH NETWORKS

NAME: _____

FIRM OR ORGANIZATION: _____

POSITION: _____

TYPE OF ORGANIZATION: Industrial ☐ University ☐ PRO ☐ Other ☐

If other, explain: _____

_____

TOTAL NUMBER OF EMPLOYEES: _____

NUMBER OF EMPLOYEES ENGAGED IN BIOTECHNOLOGICAL RESEARCH & DEVELOPMENT:

Professionals _____
Technicians _____
Support Staff _____

BIOTECHNOLOGY RESEARCH FACILITIES:

BENCH SCALE TESTING ☐
MINI-PLANT TESTING ☐
PILOT-PLANT TESTING ☐
ANALYTICAL ☐
LITERATURE ONLY ☐

Canada

A. BIOTECHNOLOGICAL INTERESTS:

1. ACTIVITIES

- OPERATIONS ☐
- ENGINEERING ☐
- TEACHING ☐
- BASIC RESEARCH ☐
- APPLIED RESEARCH ☐
- CONSULTATION ☐
- ENVIRONMENTAL IMPROVEMENT ☐
- INFORMATION GATHERING ☐
- OTHER* ☐

*Specify _____

2. UNIT OPERATIONS

MINERAL LEACHING

- ORES ☐
- CONCENTRATES ☐
- TAILINGS ☐
- WASTES ☐
- OTHER* ☐

*Specify _____

LIQUID-SOLID SEPARATION

- SETTLING AGENTS ☐
- OTHER* ☐

*Specify _____

METAL RECOVERY FROM SOLUTION

- BIOSORPTION ☐
- PRECIPITATION ☐
- METAL SEPARATION ☐
- OTHER* ☐

*Specify _____

MINERAL BENEFICIATION

- FLOCCULATION ☐
- PELLET BINDING ☐
- OTHER* ☐

*Specify _____

3. ENVIRONMENTAL IMPROVEMENT

- TAILINGS ☐
- EFFLUENT STREAMS ☐
- WASTES ☐
- OTHER* ☐

*Identify _____

_____

BIOTECHNOLOGICAL INTERESTS (cont'd)

4. COMMODITIES

COPPER	☐	URANIUM	☐
ZINC	☐	ALUMINUM	☐
LEAD	☐	COAL	☐
NICKEL	☐	OIL	☐
GOLD	☐	OTHER*	☐
SILVER	☐		

*Specify _____

_____

5. COAL AND GAS

BENEFICIATION ☐

ENVIRONMENTAL ☐

OTHER* ☐

*Specify _____

_____

6. CORROSION

CONSTRUCTION METALS ☐

PIPELINES Oil ☐

Solution ☐

Other* ☐

*Specify _____

_____

B. Benefits sought from participation in BIOMINET:

CONTACTS	☐	RESEARCH CONTRACTS	☐
INFORMATION	☐	FOR BASIC DATA	☐
APPLICATIONS	☐	FOR BENCH SCALE	☐
COSTING	☐	FOR LARGE SCALE	☐
BENEFITS	☐	FOR ASSESSMENT OF TECHNOLOGY, REVIEWS, ETC.	☐
GENERAL	☐		
WHO's WHO	☐	OTHER*	☐
OTHER*	☐		

*Specify _____

_____

*Specify _____

_____

C. Perception of Biotechnology in the Mineral Industry

On a scale of one to ten, how do you rate the importance of biotechnology to the mineral industry:

0 - Irrelevant to mineral industry

10 - We cannot proceed at a rapid enough rate to reap its benefits

RATING ☐

COMMENTS: